

Guido D'Arezzo

The concept of the hexachord was first introduced into music theory by Hucbald of Saint Amand. He noted that a regular and symmetrical pattern of the intervals appeared within the Ecclesiastical variant of the Pythagorean scale. He defined the hexachord as a series of six notes which are tuned in such a way as to create intervals of two tones, then a single semitone and then two more tones. In modern music theory, this series of intervals is frequently referred to in the abbreviated form: T - T - S - T - T

Hucbald then applied this invention to the tuning of a six string cithera (a type of lyre), such that the interval between the notes of each string was defined by the hexachord. It is quite possible that the tuning he chose for his hexachord corresponded to the modern notes: C - D - E - F - G - A

It is widely believed that Hucbald also designed the first type of musical notation. The design involved six lines in parallel on to which the words of a song were placed, with the writing going from left to right. The words were spaced such that each syllable could be accurately timed. Each line represented a string on the six string cithera and when a word was positioned on a line it indicated the note to be sung.

Recent research seems to indicate that the document in which the notational system is designed, the text *Musica Enchiriadis*, may not be the work of Hucbald of Saint Amand at all. It is probable that the work dates from some fifty years after the death of the famous Abbot and is written by someone who may also be known by the name Hucbald. A German writer on music, Martin Gerbert, published the text in the eighteenth century in his collection *Scriptores de Musica*. He appears to have assumed that Hucbald was the author due to the work's use of the tuned six string cithera.

Whoever its originator was, the core idea behind the system is almost identical to that of tablature for the guitar or bass guitar. Thus, tablature actually predates "classical" sheet music by at least 50 years and possibly as much as a century. Indeed, it is quite likely that this system serves as inspiration for the work of Guido d'Arezzo.

Guido d'Arezzo was a Benedictine Monk born in late tenth century France and is perhaps the most unlikely hero of music theory. Despite the fact that he had no experience as a composer of music he developed a system of notation which allowed for the recording of music on manuscript. His system forms the basis of modern musical notation.

Before the invention of notation, a singer would learn the entire selection of chants available to his order. These students would, in turn, become the masters of the next generation of students. Small lapses of memory introduced errors in the music. After a few generations, students from one Abbey would be learning a different piece of music to that taught at another. Guido realised that the original music was gradually dying and being replaced by these inaccurate interpretations.

He travelled to Italy to work under Bishop Theobald in the town of Arezzo in Italy in, or around, 1025. It is almost certain that soon after his arrival in Italy he began work on his system of notation in an effort to record plainsong chants for posterity.



Guido d'Arezzo c.991-c1050

Guido realised that the simpler that a scale could be made, the quicker the student could learn. He knew that the symmetrical nature of the hexatone made it easier to learn to sing. He set out to find a hymn which used the notes of the hexachord as the basis for each line and found what he needed in a Latin prayer to Saint John the Baptist by the monk and historian Paulus Diaconus (720-800AD):

Ut Queant Laxis
Resonare Fibris
Mira Gestorum
Famili Tuoram
Solve Polluti
Labii Reatum
Sancte Ioannes

The prayer roughly translates to the English phrase:

“So that we your servants may freely sing of the wonders of your deeds, cleanse the guilt from our polluted lips, Oh Saint John”.

It is separated into seven lines, the first six of which start on note which describe an ascending hexachord (i.e. the note beginning the first line is the lowest note of the hexachord, the second line begins with the a note a tone higher and so on). Like the system formerly attributed to Hucbald, the hymn very likely used the hexachord *C - D - E - F - G - A*.

Because this chant exactly fit his needs, he chose to use it as the basis for his teaching system. He took the first few letters of each phrase of the prayer and used these as the names for the notes on which that phrase started. Variations on this system are still in use to this day. It is named the *Sol-Fa* system after two of its members.

Line	Line of Hymn	d'Arezzo Sol-Fa	English Sol Fa	Modern Note
1	Ut Queant Laxis	Ut	Do	C
2	Resonare Fibris	Re	Re	D
3	Mira Gestorum	Mi	Mi	E
4	Famili Tuoram	Fa	Fa	F
5	Solve Polluti	Sol	Sol	G
6	Labii Reatum	La	La	A
7	Sancte Ioannes	-	Ti	B

Fig 2.09 : The d'Arezzo Sol-Fa and its equivalents

The d'Arezzo system continues in use for most of the next millennium although with a few changes. In the English (and continental) versions of the names, the syllable *Ut* is replaced by *Do* which is probably derived from the word *Domine* - the Latin for Lord. The seventh note in the heptatonic scale is initially given the name *Si* (from *Sancte Ioannes*), although this is altered to *Ti* because of a later development of the scale.

Although it is performed over radically different music written a millenium later, a parallel of the teaching chant used by d'Arrezzo can be seen in the song “Do-Re-Mi” from “The Sound of Music”. In the movie, each line of the song is sung starting on the exact note specified by the first word of a line. It is quite probable that the composer was aware of the work of d'Arezzo and chose to mirror it.

When teaching new, unknown pieces of music to his students, Guido continually referred them back to the hymn “Ut Queant Laxis”. Their familiarity with the latter enabled them to use as a reference point for the notes of the new material. He claimed that, by using this new method, he could teach what would ordinarily take a decade in months. Whilst this may well be an exaggeration, there is no doubt that pitch recognition training does increase the speed at which musicians learn music.

Guido also noticed that the hexachord could be found at three different places in the existing scale (including the notes B Flat and F Sharp):

	T	T	S	T	T
C	D	E	F	G	A
G	A	B	C	D	E
F	G	A	B \flat	C	D

Because the flattened B was termed “soft” (*molle*) and the natural B was called “hard” (*durum*), the hexachord starting on G was called hard and the hexachord starting on F was called soft. The final hexachord is considered “natural”. The first two of these names were eventually applied to the the names of the Major (*dur*) and Natural Minor (*moll*) scales of modern theory.

In isolation, either the six stringed cithara of Hucbald or the single hexachord of d'Arezzo are of limited use. Both writers were aware of the limits of their systems, Hucbald especially so. Each described the range of one octave and to go outside of that range it was necessary to add extra notes above and below the selected octave. Hucbald himself notes that these additional notes were needed even to notate music in the eight church modes.

It is d'Arezzo that comes up with a solution which has the most profound effect on music theory. He realised that the solution was to have more than one hexachord available and to have those additional hexachords overlapping. In that way, a singer could perform a piece by starting on a note in one of the hexachords and then change, or mutate, to another of the hexachords.

Guido assigned the hard hexachord as the lowest in the system, thereby making the note G (which he knew as *Ut*) the lowest on the scale. To differentiate between this note and its octaves, he referred to it as the *Gamma Ut*. This name is eventually contracted to the word *Gamut* and used by French musicians to mean the whole octave. Ultimately the word makes its way into the English Language with the same meaning and eventually comes to mean any entire range regardless of context.

Having placed the first hexachord, Guido then added the natural hexachord. This began on the note C and would therefore overlap the bounds of the hard hexachord on the notes C, D and E. Finally, the soft hexachord was placed such that it overlapped the natural hexachord on the notes F, G and A. Thanks to the flattened B being an integral element of the soft hexachord, the note *B molle* (B \flat) enters in to theory as a note in its own right as opposed to an alteration of another note.

The stacking of hexachords need not stop with the three so far discussed. Indeed, the system known as *Musica Recta* ("proper music") spans almost three octaves by overlapping the hexachords again. The notes take the name of the Roman letter and the combined names of the notes in the overlapped hexachords (in order from lowest to highest). Our modern system dispenses with such complication and simply numbers the notes according to which octave they are found in (see *Fig 2.10*).

Modern Note	Hard	Natural	Soft	Name
E5	La	-	-	E la
D5	Sol	-	La	D la sol
C5	Fa	-	Sol	C sol fa
B4	Mi	-	-	B mi
B \flat 4	-	-	Fa	B fa
A4	Re	La	Mi	A la mi re
G4	Ut	Sol	Re	G sol re ut
F4	-	Fa	Ut	F fa ut
E4	La	Mi	-	E la mi
D4	Sol	Re	La	D la sol re
C4	Fa	Ut	Sol	C sol fa ut
B3	Mi	-	-	B mi
B \flat 3	-	-	Fa	B fa
A3	Re	La	Mi	A la mi re
G3	Ut	Sol	Re	G sol re ut
F3	-	Fa	Ut	F fa ut
E3	La	Mi	-	E la mi
D3	Sol	Re	-	D sol re
C3	Fa	Ut	-	C fa ut
B2	Mi	-	-	B mi
A2	Re	-	-	A re
G2	Gamma Ut	-	-	Gamma Ut

Fig 2.10 : The Musica Recta scale

As an aide memoire for his pupils, d'Arezzo also designed a system for counting through the notes of the Musica Recta by using the joints on a left hand to represent them (see *Fig 2.11*). The notes of the Musica Recta are placed on the joints of the thumb and fingers in a spiral pattern. Starting with the note *Gamma Ut* on the tip of the thumb, then *A re* at the first joint and *B mi* at the second. The next four notes (C fa ut, D sol re, E la mi & F fa ut) are assigned to the joints of the four fingers that are nearest the palm. The next three notes are placed on the little finger (pinky) with the notes B fa & B mi both occupying the same place (the soft pad of each finger). Three notes are then assigned to the tips of each finger, then two at the first and second joints of the index finger. The next two notes are then assigned to the second joints of the middle and ring fingers, followed by a further two at the first joints. The final note of the pattern is the only one which is not in the spiral (E la) which is at the very tip of the middle finger

Not content with what he had already achieved, Guido did not rest on his laurels. The invention that was to have the greatest impact was still to come.

It is quite likely that d'Arezzo had been made aware of the musical notation designed by the writer of *Musica Enchiriadis*. If this is so, he would no doubt have realised that the use of overlapping hexachords would mean that the system based on the strings of a lyre would become rather too complex. A quick look at the *Musica Recta* shows a total of 22 notes - which would lead to far too many lines if each note were to have its own line.

The system of notation for which he is famous has four continuous lines across the page which make up the staff. Notes could be placed on or between these lines and these were represented by small square dots (see the lower image in Fig 2.12). In addition, short extra (extension) lines could be drawn where a note required was outside of the range of the four line staff. These would only be long enough for the note in question and would exist only where a note fell outside of the boundaries set by the staff lines.

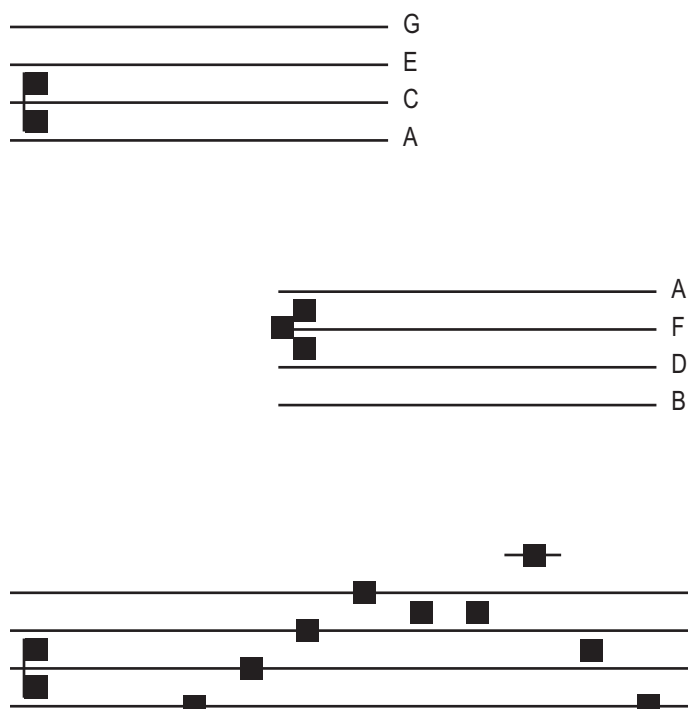


Fig 2.12 : The C Clef, F Clef and example notation



Fig 2.11 : The Guidonian Hand (Manus Guidonis)

His original notation used a yellow line to indicate the position of the note Ut (C) and a red line was used to indicate the position of the note Fa (F). This leads to the later development of the clef.

In this later system, the note values that each of the lines represent is indicated by the positioning of a mark at the start of each stave. These marks, known as clefs, could be positioned on any of the upper three lines of the four line staff. These marks came in two forms, one of which indicated the position of the note Ut or Do (called the C clef) and one which indicated the position of the note Fa (the F clef).

Not only was each note markable as a separate square, but there were symbols which represented certain runs of notes (called *neumes*). There were also marks that could be made to indicate a silence or pause as well as a mark designed to represent the "flat" symbol required for the B \flat found in the *Musica Recta* (which was a square "b" shape).

A full description of this system is outside of the bounds of this book and readers who are interested should look more closely into the music of Gregorian chants and/or the history of music.